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EXAMINER
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VAN ROY, TOD THOMAS

ART UNIT	PAPER NUMBER
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2828

DATE MAILED: 08/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/695,583	Applicant(s) CAPRARA ET AL.	
	Examiner <i>Tr. J. Roy</i> Tod T. Van Roy	Art Unit 2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 45-86 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 45-86 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 October 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____.  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>10/28/03, 5/20/05</u> .   | 6) <input type="checkbox"/> Other: ____.                                    |

## **DETAILED ACTION**

### ***Drawings***

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: Element #37 was referred to in the specification, but did not seem to correctly relate to the pictured block. Explanation of the correlation between the specification and the figures is requested. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Specification***

The disclosure is objected to because of the following informalities:

Page 34 line 22 reads "common axial path 37", which was not found in the corresponding figures.

Appropriate correction is required.

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### ***Claim Objections***

Claim 56 is objected to because of the following informalities:

Claim 56 is written as depending from claim 45, and is believed to more appropriately depend from claim 53, and has been examined as such.

Appropriate correction is required.

### ***Double Patenting***

Claim 69 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 68. Claim 69 is believed to contain typos which when corrected would make the claim a duplicate of claim 68.

When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 53 and 58 are rejected under 35 U.S.C. 102(a) as being anticipated by Alford et al. (W.J. Alford et al., Intracavity frequency doubling of an optically-pumped, external-cavity surface-emitting semiconductor laser, " Advanced Solid State Laser Conference, Sandia National Laboratories, SAND-98-21 08C CONF-990105 December 31, 1998).

With respect to claim 53, Alford discloses a laser comprising: a laser-resonator having a resonator axis and being terminated by first (fig.1 DBR) and second mirrors (fig.1 HR coated side); an Ops-structure having a surface-emitting gain-structure (fig.1), said gain-structure including a plurality of active layers having separator layers therebetween, said active layers having a composition  $\text{In}_x\text{Ga}_{1-x}\text{N}$  where  $0.0 < x < 1.0$ , said composition selected to provide emission of electromagnetic radiation at a fundamental wavelength within a gain bandwidth of said gain-structure characteristic of said composition (pg.4 col.2 1<sup>st</sup> para.), when optical-pump light is incident on said gain-structure; said OPS structure being supported on a substrate located outside said laser-resonator with said gain-structure of said Ops-structure being inside said laser resonator (fig.1, sub under DBR mirror, outside resonator); an optical arrangement for delivering said pump-light to said gain-structure (fig.1 pump arranged at bottom, non-

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normal), thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator, and wherein one of said first and second mirrors is partially transmissive for delivering said laser radiation from said laser resonator (fig.1 HR mirror acts as output for 2<sup>nd</sup> harmonic).

With respect to claim 58, Alford discloses the mirror structure surmounted by said gain structure is the first mirror (fig.1, DBR mirror on left).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 45-47, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz et al. (A. Rosiewicz et al., "Optical pumping improves VCSEL performance" Laser Focus World. June, 1997, pp. 133-136) in view of Alford.

With respect to claim 45, Rosiewicz teaches a laser comprising: a laser-resonator including an output coupling mirror (fig.1); an Ops structure having a surface-emitting gain-structure (fig.1 right side), said gain-structure including a plurality of active layers having separator layers therebetween said active layers having a composition selected to provide emission of electromagnetic radiation at a fundamental wavelength within a gain bandwidth of said gain-structure (pg.1 col.1 para.3), when optical-pump light is incident on said gain-structure; said OPS structure being supported on a substrate located outside said laser-resonator with said gain-structure of said Ops-structure being inside said laser resonator (fig.1, DBR above substrate in resonator, pg.1 col.1 para.3), a heat-sink arrangement for cooling said Ops-structure (fig.1 heat sink); and an optical arrangement for delivering said pump-light to said gain-structure (fig.1 pump and optics), thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator; and radiation exiting the cavity through the output coupling mirror is greater than about 100 mw (pg.3 col.1 para.3, >600mw). Rosiewicz does not teach an optically nonlinear crystal located in said laser-resonator and arranged for frequency-doubling said fundamental laser-radiation thereby providing frequency-doubled radiation having a wavelength half of said fundamental-wavelength. Alford teaches an OPS pumping structure containing a frequency doubling crystal (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz with the nonlinear crystal of Alford in order to shift the output frequency and obtain a new

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wavelength usable in applications such as displays, and data storage (Alford, pg.2 col.1 para.1).

With respect to claim 46, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, and Rosiewicz further teaches the pump angle to be non-normal (fig.1).

With respect to claim 47, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, and Rosiewicz further teaches the output coupler to have a concave surface (fig.1, concave external mirror).

With respect to claim 52, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, and Rosiewicz further teaches the OPS structure to contain a mirror structure surmounted by a gain structure and the mirror structure is the first mirror (fig.1 DBR).

Claims 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Alford, and further in view of Selker et al. (US 5485482).

With respect to claims 48-49, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, but do not teach the mode quality to be about 1.2. Selker teaches a diode pumped laser wherein the mode quality is taught to be about 1.2 (col.4 lines 49-50, 1.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz and Alford with the mode quality of Selker to minimize beam divergence and improve coupling of the radiation to optics, as well as reduce system losses.



Claims 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Alford, and further in view of Tsunekane (US 5870415).

With respect to claims 50-51, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, but do not teach a birefringent filter to be located within the resonator. Tsunekane teaches a folded cavity, pumped, 2<sup>nd</sup> harmonic system wherein a birefringent filter is formed (col.1 lines 66-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz and Alford with the filter of Tsunekane in order to closely select a desired oscillation bandwidth, and suppress noise generation within the system (Tsunekane, col.2 lines 4-10).

Claims 54-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Selker.

With respect to claims 54-55, Alford teaches the OPS structure as outlined in the rejection to claim 53, but does not teach the mode quality to be about 1.2. Selker teaches a diode pumped laser wherein the mode quality is taught to be about 1.2 (col.4 lines 49-50, 1.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Alford with the mode quality of Selker to minimize beam divergence and improve coupling of the radiation to optics, as well as reduce system losses.

Claims 56-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Tsunekane.

With respect to claims 56-57, Alford teaches the OPS structure as outlined in the rejection to claim 53, but does not teach a birefringent filter to be located within the resonator. Tsunekane teaches a folded cavity, pumped, 2<sup>nd</sup> harmonic system wherein a birefringent filter is formed (col.1 lines 66-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Alford with the filter of Tsunekane in order to closely select a desired oscillation bandwidth, and suppress noise generation within the system (Tsunekane, col.2 lines 4-10).

Claims 59-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Mooradian (US 5131002).

With respect to claims 59-60, Rosiewicz teaches a laser comprising: a laser-resonator formed by at least two mirrors (fig.1 external, DBR); an Ops-structure having a surface-emitting gain-structure (fig.1), said gain-structure including a plurality of active layers having separator layers therebetween said active layers having a composition selected to provide emission of electromagnetic radiation at a predetermined fundamental-wavelength when optical-pump light is incident on said gain-structure (pg.1 col.1 para.3); said laser-resonator configured to include said gain-structure of said OPS-structure (fig.1 gain structure in resonator since DBR is underneath); an optical arrangement for delivering said pump-light to said gain-structure (fig.1 pump and

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optics), thereby causing fundamental laser-radiation having said fundamental-wavelength to circulate in said laser-resonator; a heat-sink arrangement for cooling said Ops-structure and said laser-resonator (fig.1 heat sink), said Ops-structure, said heat-sink arrangement and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers output-radiation having said fundamental-wavelength. Rosiewicz does not teach the fundamental wavelength to be emitted at a power greater than 2 W. Mooradian teaches a multiple OPS, and reflector (fig.1 mirrors #10, 26, 32, and 34), structure wherein it is taught that the outputs can be over 100W (col.1 lines 62-66). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the single OPS structure of Rosiewicz with the multiple OPS, and reflector, structure of Mooradian in order to induce multiple reflections through the gain media and achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

Claims 61-63, 65-67, and 70-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Mooradian.

With respect to claims 61-63 and 65-67, Alford teaches the OPS structure as outlined in the rejection to claim 53, and further teaches the emission wavelength to be within 425-1800nm (pg.4 col.1 para.2, 980nm), and after frequency doubling between 212-900nm ( $980/2=490\text{nm}$ ). Alford does not teach the resonator to be formed by at least three other reflectors, one of which being an additional OPS. Mooradian teaches a multiple OPS, and reflector (fig.1 mirrors #10, 26, 32, and 34), structure wherein it is

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taught that the outputs can be over 100W (col.1 lines 62-66). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the single OPS structure of Alford with the multiple OPS, and reflector, structure of Mooradian in order to induce multiple reflections through the gain media and achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

With respect to claim 70, Alford teaches a method of irradiating a material for cutting, ablating, heating, or photochemically altering the material (pg.3 col.1 para.1, data storage writing) comprising: providing an OPS laser (outlined in the rejection to claim 53), and delivering the radiation to the material (inherent in performing the operations in pg.3 col.1 para.1). Alford does not teach the output power to be greater than 2W. Mooradian teaches a multiple OPS, and reflector (fig.1 mirrors #10, 26, 32, and 34), structure wherein it is taught that the outputs can be over 100W (col.1 lines 62-66). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the single OPS structure of Alford with the multiple OPS, and reflector, structure of Mooradian in order to induce multiple reflections through the gain media and achieve high output powers usable in a multitude of industrial applications such as cutting or ablating.

With respect to claim 71, Alford and Mooradian teach the method as outlined in the rejection to claim 70, wherein Mooradian teaches the radiation to be delivered via a light guide (light guided by reflections through resonator directed and outcoupled through mirror #34). It would have been obvious to one of ordinary skill at the time of the

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invention to combine the method of Alford and Mooradian with the light guide of Mooradian for proper direction of the radiation to the target.

With respect to claim 72, Alford and Mooradian teach the method as outlined in the rejection to claim 70, wherein Mooradian teaches the radiation to be delivered via a single axial mode (col.4 lines 6-10). It would have been obvious to one of ordinary skill at the time of the invention to combine the method of Alford and Mooradian with the mode of operation of Mooradian for improved irradiating control of the target based on the use of the single Gaussian mode profile.

Claims 64, and 68-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Mooradian, and further in view of Deacon (US 5206868).

With respect to claims 64 and 68-69, Alford and Mooradian teach the OPS structure as outlined in the rejection to claims 61 and 65, but do not teach the use of a second nonlinear crystal for frequency tripling. Deacon teaches a folded cavity system which uses an additional nonlinear crystal for frequency tripling (col.2 lines 40-43). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Alford and Mooradian with the additional nonlinear crystal of Deacon to convert to alternate multiple wavelengths for use in manufacturing, displays, etc., which was not possible to obtain from a single light emitter.

Claims 73-74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Mooradian, and further in view of Kuznetsov et al. (M. Kuznetsov et al.,

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'High-power (>0.5-W CW) Diode-Pumped Vertical-External-cavity Surface-Emitting Semiconductor Lasers with Circular TEM<sub>00</sub> Beams" IEEE Photonics Technology Letters Vol. 9, No. 8, August 1997, pp. 1063-1065).

With respect to claims 73-74, Alford teaches the OPS structure as outlined in the rejection to claim 53, and further teaches the wavelength to be 980nm (pg.4 col.1 para.2, 980nm), and after frequency doubling between 212-900nm ( $980/2=490\text{nm}$ ). Alford does not teach the OPS structure to have an output power greater than 5W or to have a plurality of transverse modes. Mooradian teaches a multiple OPS, and reflector (fig.1 mirrors #10, 26, 32, and 34), structure wherein it is taught that the outputs can be over 100W (col.1 lines 62-66). Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the single OPS structure of Alford with the multiple OPS and reflector structure of Mooradian, and the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

Claims 75-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Alford and further in view of Kuznetsov.

With respect to claims 75-76, Rosiewicz and Alford teach the OPS structure as outlined in the rejection to claim 45, but do not teach the use of multiple modes. Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). It would have been obvious to one

of ordinary skill in the art at the time of the invention to combine the single OPS structure of Alford with the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

Claim 77 is rejected under 35 U.S.C. 103(a) as being unpatentable over Alford in view of Tsunekane, and further in view of Kuznetsov and Liu (US 4048515).

With respect to claim 77, Alford teaches the OPS structure as outlined in the rejection to claim 53, but does not teach the OPS structure to have a wavelength selective element, operate in multiple modes, or have a folded cavity containing the nonlinear crystal with an output mirror transmissive to the 2<sup>nd</sup> harmonic radiation and reflective to the fundamental. Tsunekane teaches a folded cavity, pumped, 2<sup>nd</sup> harmonic system wherein a birefringent filter is formed (col.1 lines 66-67). Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). Liu teaches a folded cavity containing a nonlinear crystal (fig.1 #15) with an output mirror configured to be transmissive to 2<sup>nd</sup> harmonic light and reflective to the fundamental, including the use of line-narrowing when using the nonlinear crystal (col.4 lines 50-60, fig.2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Alford with the filter of Tsunekane in order to closely select a desired oscillation bandwidth and suppress noise generation within the system (Tsunekane, col.2 lines 4-10), and the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding, and the folded cavity and

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output mirror of Liu to prevent 2<sup>nd</sup> harmonic radiation from entering the gain media, preventing losses, as well as the line narrowing to maximize 2<sup>nd</sup> harmonic power conversion (leading to the spectral range being properly aligned with the gain bandwidth).

Claims 78-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu and further in view of Kuznetsov.

With respect to claims 78-79, Rosiewicz teaches the OPS structure as outlined in the rejection to claim 45, but does not teach the resonator to have first and second arms with a folded cavity containing a nonlinear crystal and an output mirror transmissive to 2<sup>nd</sup> harmonic light and reflective to fundamental, or to operate in multiple modes. Liu teaches a two arm, folded cavity containing a nonlinear crystal (fig.1 #15) with an output mirror configured to be transmissive to 2<sup>nd</sup> harmonic light and reflective to the fundamental. Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). It would have been obvious to one of ordinary skill at the time of the invention to combine the OPS structure of Rosiewicz with the folded cavity and output mirror of Liu to prevent 2<sup>nd</sup> harmonic radiation from entering the gain media, preventing losses, as well as the use of the nonlinear crystal to generate alternate wavelengths, and additionally the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding.



Claim 80 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu and further in view of Tsunekane.

With respect to claim 80, Rosiewicz teaches the OPS structure as outlined in the rejection to claim 45, including a diode laser for the pump light (fig.1), as well as lens for focusing the pump light to the OPS structure (fig.1). Rosiewicz does not teach the use of a fold mirror or a folded cavity containing a nonlinear crystal and an output mirror transmissive to 2<sup>nd</sup> harmonic light and reflective to fundamental, or the use of a birefringent filter. Liu teaches a two arm, folded cavity containing a nonlinear crystal (fig.1 #15) with an output mirror configured to be transmissive to 2<sup>nd</sup> harmonic light and reflective to the fundamental. Tsunekane teaches a folded cavity, pumped, 2<sup>nd</sup> harmonic system wherein a birefringent filter is formed (col.1 lines 66-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz with the folded cavity and output mirror of Liu to prevent 2<sup>nd</sup> harmonic radiation from entering the gain media, preventing losses, as well as the use of the nonlinear crystal to generate alternate wavelengths, and additionally the use of the birefringent filter to closely select a desired oscillation bandwidth, and suppress noise generation within the system (Tsunekane, col.2 lines 4-10).

Claims 81-82 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu and further in view of Tsunekane and Holsinger (US 5892783).

With respect to claims 81-82, Rosiewicz, Liu, and Tsunekane teach the OPS structure as outlined in the rejection to claim 80, but do not teach the fold mirror to be

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curved, or the cavity length to be at least 5cm. Holsinger teaches a folded cavity system and nonlinear crystal wherein the cavity length is between 1m and 10cm (col.5 lines 49-54). Rosiewicz teaches the use of a curved output-coupling mirror (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz, Liu, and Tsunekane with the cavity length of Holsinger to increase the number of axial modes and utilize a broader gain bandwidth (col.5 lines 49-58) for raising output power, and additionally use the curved mirror of Rosiewicz as the transmissive output coupling mirror to produce a round beam for more efficient power extraction (pg.1 col.2 para.2).

Claim 83 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu, Tsunekane and Shum (US 5848082).

With respect to claim 83, Rosiewicz, Liu, and Tsunekane teach the OPS structure as outlined in the rejection to claim 80, but do not teach the use of diamond between the heat sink and OPS structure. Shum teaches a heat sink for an optical system (abs.) using a diamond material mounted on top of a copper heat sink (col.5 line 57). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz, Liu, and Tsunekane with the diamond/copper heat sink of Shum in order to provide for low thermal resistance and good heat transfer characteristics (Shum, col.5 lines 58-59).

Claims 84-85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu, Tsunekane, Shum, and Holsinger.

With respect to claims 84-85, Rosiewicz, Liu, Tsunekane, and Shum teach the OPS structure as outlined in the rejection to claim 83, but do not teach the use of multiple modes or a cavity length of at least 5cm. Holsinger teaches a folded cavity system and nonlinear crystal wherein the cavity length is between 1m and 10cm (col.5 lines 49-54). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz, Liu, Tsunekane, and Shum with the cavity length of Holsinger to increase the number of axial modes and utilize a broader gain bandwidth (col.5 lines 49-58) for raising output power.

Claim 86 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosiewicz in view of Liu, Tsunekane, and Kuznetsov.

With respect to claim 86, Rosiewicz, Liu, and Tsunekane teach the OPS structure as outlined in the rejection to claim 80, but do not teach the use of multiple modes. Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of Rosiewicz, Liu, and Tsunekane with the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 45, 47, 50-53, 56-61, 64-65, 68, 73, 75-78, 80-81, 83, 85-86 rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 3, 5, 13-14, 23-25, 34-35 of U.S. Patent No. 6285702. Although the conflicting claims are not identical, they are not patentably distinct from each other because:

Claims 45 and 52 and 58 are taught by claim 1 of '702.

Claim 47 is taught by claims 1 and 25 of '702.

Claims 50, and 56 are taught by claims 1 and 13 of '702.

Claims 51, and 57 are taught by claims 1 and 14 of '702.

Claim 53 is taught by claims 1 and 5 of '702.

Claim 59 is taught by claims 1 and 2 of '702.

Claims 60-61 and 65 are taught by claims 1 and 23 of '702.

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Claim 64 is taught by claims 34 and 35 of '702.

Claim 68 is taught by claim 34 of '702.

Claims 73, 75-76, 78, 86 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 3, 5, 13-14, 18, 23-25 of U.S. Patent No. 6285702 in view of Kuznetsov.

Claims 73, and 75-76 are taught by '702 in claim 1 excluding having multiple transverse modes. Kuznetsov teaches an OPS structure wherein multiple modes are taught to lead to increasing higher output powers (pg.3 col.1 para.2). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the OPS structure of '702 with the multiple modes of Kuznetsov in order to achieve high output powers usable in a multitude of industrial applications such as cutting or welding.

Claim 78 is taught by '702 in claim 34 excluding having multiple transverse modes. Kuznetsov teaches this as described above.

Claim 86 is taught by '702 in claims 1, 18, and 23 excluding having multiple transverse modes. Kuznetsov teaches this as described above.

### ***Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR



MINSUN OH HARVEY  
PRIMARY EXAMINER